

The Sheraton-Silver Spring is a mile from the Capital Beltway and is easily accessible to the entire metropolitan area and by direct limousine service to Washington airports. The hotel offers free parking to seminar participants.



**REGISTRATION:** Registration, including course materials and luncheons, is \$225 for the first participant and \$200 for others from the same organization. Checks for registration should be made payable to The Institute for Advanced Technology. Classes will begin at 9:00 a.m. and end at 5:00 p.m. daily.



#### OTHER SUBJECTS:

- Data Analysis - A Survey of Techniques
- Introduction to the Design of Experiments
- Sales & Business Forecasting
- Multivariate Analysis of Marketing Data
- Computer-Assisted Instruction
- Project Management Seminar - Workshop
- Advanced Management Systems Analysis
- Hospital and Medical Information Systems
- Introduction to Management Science/  
Operations Research
- A New Vector Approach to Regression  
Analysis and Computers in Research
- The Mini-Computer - Impact on the '70's
- Management Information Systems
- Microfilm Information Systems
- Model Building

**OTHER PROGRAMS:** As an extension to the publicly offered program, The Institute for Advanced Technology offers seminars at the clients' premises or at special IAT facilities. The presentation of special sessions may be a replica of the regularly scheduled program, or they may be specially tailored to meet clients' requirements.

**ABOUT IAT:** The Institute for Advanced Technology is a directorate of Control Data Education Institutes. The nature of computer-based methods makes education an integral part of Control Data operations. The Institute provides education in computer, management, mathematical and statistical sciences. Faculty members are drawn primarily from the ranks of Control Data Corporation's professional staff. The curriculum consists of subjects in which these professionals are experts—recognized for excellence in day-to-day application of the art and science of computer usage to the real problems of business and industry. This teacher-doer relationship is formalized in The Institute for Advanced Technology. Sharing these skills through seminars in major cities and special in-plant training programs is the goal of The Institute for Advanced Technology.

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For further information, or to be placed on the mailing list for future announcements, write:

**REGISTRAR**  
The Institute for Advanced Technology

**CONTROL DATA**  
CORPORATION

5272 River Road, Washington, D.C. 20016  
Phone: Area Code 301/652-2268, Ext. 245

*The Institute for Advanced Technology*

**CONTROL DATA**  
CORPORATION



—presents—

# INTEGER PROGRAMMING

with

## THREE 2-DAY SEMINARS

● September 29-30, 1970  
Washington, D.C.

● October 27-28, 1970  
New York, N.Y.

● November 17-18, 1970  
Chicago, Ill.

**THE COURSE:** Integer programming is a product of the last 12 years. This powerful, versatile tool is at present the most rapidly developing area of mathematical programming. The seminar will survey the types of problems that can be formulated, though often not in a straightforward way, as integer programs. It will discuss, with numerical examples, the main techniques used today for solving pure and mixed integer programs, their power and limitations. It will present information on available computer codes, reported results and a number of practical applications. A brief review of some recent research topics will be given at the end.

**WHO SHOULD ATTEND:** A two-day seminar for operations research analysts, practitioners of management science, systems analysts, computer scientists, engineers and economists, interested in optimization techniques in general and mathematical programming in particular. Participants should have a background in elementary linear algebra and in linear programming. No knowledge of integer programming itself is required.

## COURSE OUTLINE

### The Modeling Potential of Integer Programming

- Discontinuities; discrete variables; binary decisions
- Disjunctive and conditional constraints
- Non-convex piece-wise linear functions
- Special structures: matching, covering, set covering
- Sequencing: traveling salesman-type problems

### Cutting Plane Methods

- Geometry of integer programming
- Generating cuts
- Gomory's cyclic algorithm

The all-integer algorithm  
Application to aircraft crew scheduling

### Implicit Enumeration Methods

- Searching the solution-graph
- "Depth first" versus "breadth first"
- Exclusion tests, bounds
- Surrogate constraints
- Applications to capital budgeting, industrial development planning

### Mixed-Integer Programming Techniques

- Duality in integer programming
- Partitioning procedures
- Implicit enumeration in the mixed case
- A branch and bound algorithm
- Applications to location problems, pipeline network planning

### Brief Review of some Present Research Trends

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The right to cancel the seminar or to amend the syllabus is reserved.

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## THE INSTRUCTOR:



**DR. EGON BALAS** is Professor of Industrial Administration and Applied Mathematics at Carnegie-Mellon University (Pittsburgh, Pennsylvania). Dr. Balas is a leading authority on integer programming. His name is closely associated with the development of implicit enumeration (branch and bound) methods,

which constitute a basic building-block of the more efficient computer codes in use today for the solution of problems like capital budgeting, optimization of R & D projects, plant location, etc. Other areas in which he has done extensive research, reported in more than 50 publications, include scheduling and sequencing, networks, decomposition (mathematical techniques for decentralizing economic systems), distribution-type problems, etc. Dr. Balas is an Associate Editor of Operations Research. He also acts as a consultant, and has worked in this capacity for Control Data Corporation and IBM, as well as for firms in the steel, oil, timber, textile, and building industries.

**LOCATION:** Seminars are conducted at the hotels listed below. Cost of hotel rooms is not included in the registration. IAT does not arrange hotel reservations; however, the hotels will hold a block of rooms for seminar participants until two weeks before the seminar. Hotel reservation cards will be forwarded with registration confirmations. Please contact the hotels directly for reservations, mentioning, IAT, Control Data Corporation; the seminar; and dates attending.

September 29-30, 1970  
Sheraton-Silver Spring  
8727 Colesville Road  
Silver Spring, Maryland 20910

October 27-28, 1970  
Barbizon-Plaza Hotel  
106 Central Park South  
New York, New York 10019

November 17-18, 1970  
Sheraton-O'Hare Motor Hotel  
6810 North Mannheim Road  
Chicago, Illinois 60018